CLAIMS

What is claimed is:

Sub A1

1. A method for automatically routing an integrated circuit, the method comprising the computer-implemented steps of:

receiving integrated circuit layout data that defines a set of two or more integrated circuit devices to be included in the integrated circuit;

receiving integrated circuit connection data that specifies one or more electrical connections to be made between the integrated circuit devices;

determining, based upon the integrated circuit layout data and the integrated circuit connection data, a set of one or more routing indicators that indicate a set of one or more preferable intermediate routing locations for a routing path between first and second integrated circuit devices from the set of two or more integrated circuit devices;

determining, based upon the integrated circuit layout data, the integrated circuit connection data and the set of one or more routing indicators, the routing path between the first and second integrated circuit devices, wherein the routing path satisfies specified design criteria; and

updating the integrated circuit layout data to generate updated integrated circuit layout data that reflects the routing path between the first and second integrated circuit devices.

BOARD DECISION

2. The method as recited in Claim 1, wherein determining ~~the routing~~ path includes determining, based upon the integrated circuit layout data, the integrated circuit connection data, bias direction criteria and straying limit criteria, the routing path between the first and second integrated circuit devices, wherein the bias direction criteria specifies a preferred routing direction for a routing path between first and

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second integrated circuit devices from the set of two or more integrated circuit devices and the straying limit criteria defines a routing region in which the routing path between the first and second integrated circuit devices may be placed.

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3. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes

identifying one or more obstacles that block the routing path,

determining, based upon the integrated circuit layout data, the integrated circuit connection data and the one or more obstacles, one or more additional routing indicators, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the one or more additional routing indicators, the routing path between the first and second integrated circuit devices.

4. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes

identifying one or more obstacles that block the routing path,

changing specified straying limit criteria that defines a routing region in which the routing path between the first and second integrated circuit devices may be placed to generate changed specified straying limit criteria that defines a modified routing region, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the changed specified straying limit criteria, the routing path between the first and second integrated circuit devices.

BOARD DECISION

5. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes
identifying one or more obstacles that block the routing path,
determining a set of one or more layer changes to allow the routing path to avoid the one more obstacles, and
determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the set of one or more layer changes, the routing path between the first and second integrated circuit devices.

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6. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes
identifying one or more obstacles that block the routing path,
determining a set of one or more bends to be included in the routing path to avoid the one more obstacles, and
determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the set of one or more bends, the routing path between the first and second integrated circuit devices.

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7. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes
identifying one or more obstacles that block the routing path,
determining one or more portions of the routing path to be ripped up and rerouted, and
determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the one or

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~~more portions of the routing path to be ripped up and rerouted, the routing path between the first and second integrated circuit devices.~~

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~~8. The method as recited in Claim 7, wherein determining the routing path between the first and second integrated circuit devices further includes~~

~~determining one or more portions of one or more other routing paths to be ripped up and rerouted, and~~

~~determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators, the one or more portions of the routing path to be ripped up and rerouted and the one or more portions of the one or more other routing paths to be ripped up and rerouted, the routing path between the first and second integrated circuit devices.~~

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~~9. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices further includes~~

~~identifying one or more obstacles that block the routing path,~~

~~determining one or more portions of one or more other routing paths to be ripped up and rerouted, and~~

~~determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the one or more portions of the one or more other routing paths to be ripped up and rerouted, the routing path between the first and second integrated circuit devices.~~

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10. The method as recited in Claim ~~1~~, wherein determining the routing path between the first and second integrated circuit devices includes

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identifying one or more obstacles that block the routing path, and determining, based upon the integrated circuit layout data, the integrated circuit connection data and the set of one or more routing indicators and the routing path between the first and second integrated circuit devices, wherein the routing path is routed from the second integrated circuit device to the first integrated circuit device.

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11. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated ~~circuit~~ devices includes identifying one or more obstacles that block the routing path, determining one or more locations to employ corner clipping to provide additional space for routing the routing path, and determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the one or more locations to employ corner clipping, the routing path between the first and second integrated circuit devices.

12. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes identifying one or more obstacles that block the routing path, determining one or more integrated circuit layout objects to be moved to provide additional space for routing the routing path, and determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and moving the one or more integrated circuit layout objects, the routing path between the first and second integrated circuit devices.

13. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes

examining data that indicates whether changes can be made to one or more layout objects defined by the integrated circuit layout data to accommodate the routing of the routing path, and

if the data indicates that changes can be made to the one or more layout objects defined by the integrated circuit layout data to accommodate the routing of the routing path, then

making one or more changes to the one or more layout objects defined by the integrated circuit layout data, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the one or more changes made to the one or more layout objects, the routing path between the first and second integrated circuit devices.

BOARD DECISIONS

14. The method as recited in Claim 13, further comprising generating data that specifies the one or more changes made to the one or more layout objects.

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15. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes

determining a set of one or more routing targets to which the routing path is to be routed, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the set of one or more routing targets, the routing path between the first and second integrated circuit devices.

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16. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes performing one or more design rule checks on one or more portions of the routing path as the routing path is being determined.

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2 ~~17~~. The method as recited in Claim 1 ~~16~~, further comprising performing a design rule check on the updated integrated circuit layout data, wherein the design rule check does not check one or more layout objects previously checked during determination of the routing path.

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18. The method as recited in Claim 1, wherein determining the routing path between the first and second integrated circuit devices includes

extending the routing path a specified amount to generate an extended portion of the routing path, and

performing a design rule check on only the extended portion of the routing path.

BOARD DECISION

19. The method as recited in Claim 1, wherein all attachment and bend angles defined by the updated integrated circuit layout data are multiples of ninety degrees.

BOARD DECISION

20. The method as recited in Claim 1, wherein one or more attachment or bend angles defined by the updated integrated circuit layout data are multiples of other than ninety degrees.

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4 ~~21~~. A method for automatically verifying an integrated circuit layout, the method comprising the computer-implemented steps of:

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receiving integrated circuit layout data that defines a set of two or more layout objects contained in the integrated circuit layout;

performing a first design rule check on a layout object from the set of two or more layout objects by evaluating the layout object against specified design criteria;

changing one or more values defined by the specified design criteria to generate updated specified design criteria, wherein the changing of the one or more values is performed after a specified amount of time has elapsed and is made with respect to either the layout object or one or more other layout objects from the set of two or more layout objects; and

performing a second design rule check on the layout object by evaluating the layout object against the updated specified design criteria.

22. A method for automatically routing an integrated circuit, the method comprising the computer-implemented steps of:

receiving integrated circuit layout data that defines a set of two or more integrated circuit devices to be included in the integrated circuit;

receiving integrated circuit connection data that specifies one or more electrical connections to be made between the integrated circuit devices;

determining, based upon the integrated circuit layout data and the integrated circuit connection data, a set of two or more join points that are to be electrically connected;

determining, based upon the integrated circuit layout data and the set of two or more join points, one or more routing paths to connect the set of two or more join points, wherein the one or more routing paths satisfy specified design criteria; and

updating the integrated circuit layout data to generate updated integrated circuit layout data that reflects the one or more routing paths.

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5 ~~23.~~ A method for automatically routing an integrated circuit, the method comprising the computer-implemented steps of:

receiving integrated circuit layout data that defines a set of two or more integrated circuit devices to be included in the integrated circuit;

receiving integrated circuit connection data that specifies one or more electrical connections to be made between the integrated circuit devices;

determining, based upon the integrated circuit layout data and the integrated circuit connection data, a routing path between first and second integrated circuit devices that satisfies specified design criteria, wherein determining the routing path between the first and second integrated circuit devices includes

determining whether the distance to be routed for a portion of the routing path exceeds a specified distance, and

if the distance to be routed for the portion of the routing path does not exceed the specified distance, then routing the portion of the routing path in a single step; and

updating the integrated circuit layout data to generate updated integrated circuit layout data that reflects the routing path between the first and second integrated circuit devices.

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24. A computer-readable medium carrying one or more sequences of one or more instructions for automatically routing an integrated circuit, the one or more sequences of one or more instructions including instructions which, when executed by one or more processors, cause the one or more processors to perform

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the steps of:

receive integrated circuit layout data that defines a set of two or more integrated circuit devices to be included in the integrated circuit;

receive integrated circuit connection data that specifies one or more electrical connections to be made between the integrated circuit devices;

determine, based upon the integrated circuit layout data and the integrated circuit connection data, a set of one or more routing indicators that indicate a set of one or more preferable intermediate routing locations for a routing path between first and second integrated circuit devices from the set of two or more integrated circuit devices;

determine, based upon the integrated circuit layout data, the integrated circuit connection data and the set of one or more routing indicators, the routing path between the first and second integrated circuit devices, wherein the routing path satisfies specified design criteria; and

update the integrated circuit layout data to generate updated integrated circuit layout data that reflects the routing path between the first and second integrated circuit devices.

25. The computer-readable medium as recited in Claim 24, wherein determining the routing path includes determining, based upon the integrated circuit layout data, the integrated circuit connection data, bias direction criteria and straying limit criteria, the routing path between the first and second integrated circuit devices, wherein the bias direction criteria specifies a preferred routing direction for a routing path between first and second integrated circuit devices from the set of two or more integrated circuit devices and the straying limit criteria defines a routing region in which the routing path between the first and second integrated circuit devices may be placed.

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26. The computer-readable medium as recited in Claim 24, wherein determining the routing path between the first and second integrated circuit devices includes identifying one or more obstacles that block the routing path,

determining, based upon the integrated circuit layout data, the integrated circuit connection data and the one or more obstacles, one or more additional routing indicators, ~~and~~

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the one or more additional routing indicators, the routing path between the first and second integrated circuit devices.

BOARD DECISION

27. The computer-readable medium as recited in Claim 24, wherein determining the routing path between the first and second integrated circuit devices includes identifying one or more obstacles that block the routing path,

changing specified straying limit criteria that defines a routing region in which the routing path between the first and second integrated circuit devices may be placed to generate changed specified straying limit criteria that defines a modified routing region, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the changed specified straying limit criteria, the routing path between the first and second integrated circuit devices.

BOARD DECISION

28. The computer-readable medium as recited in Claim 24, wherein determining the routing path between the first and second integrated circuit devices includes identifying one or more obstacles that block the routing path,

~~determining a set of one or more layer changes to allow the routing path to avoid the one more obstacles, and~~

~~determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the set of one or more layer changes, the routing path between the first and second integrated circuit devices.~~

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~~29. A system for automatically routing an integrated circuit, system comprising:~~

~~a data storage mechanism having stored therein~~

~~integrated circuit layout data that defines a set of two or more integrated circuit devices to be included in the integrated circuit, and~~

~~integrated circuit connection data that specifies one or more electrical connections to be made between the integrated circuit devices; and~~

~~a routing mechanism communicatively coupled to the data storage mechanism, the routing mechanism being configured to~~

~~determine, based upon the integrated circuit layout data and the integrated circuit connection data, a set of one or more routing indicators that indicate a set of one or more preferable intermediate routing locations for a routing path between first and second integrated circuit devices from the set of two or more integrated circuit devices,~~

~~determine, based upon the integrated circuit layout data, the integrated circuit connection data and the set of one or more routing indicators, the routing path between the first and second integrated circuit devices, wherein the routing path satisfies specified design criteria, and~~

update the integrated circuit layout data to generate updated integrated circuit layout data that reflects the routing path between the first and second integrated circuit devices.

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30. The system as recited in Claim 29, wherein the routing mechanism is further configured to determine the routing path by determining, based upon the integrated circuit layout data, the integrated circuit connection data, bias direction criteria and straying limit criteria, the routing path between the first and second integrated circuit devices, wherein the bias direction criteria specifies a preferred routing direction for a routing path between first and second integrated circuit devices from the set of two or more integrated circuit devices and the straying limit criteria defines a routing region in which the routing path between the first and second integrated circuit devices may be placed.

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31. The system as recited in Claim 29, wherein the routing mechanism is further configured to determine the routing path between the first and second integrated circuit devices by

identifying one or more obstacles that block the routing path,

determining, based upon the integrated circuit layout data, the integrated circuit connection data and the one or more obstacles, one or more additional routing indicators, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the one or more additional routing indicators, the routing path between the first and second integrated circuit devices.

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32. The system as recited in Claim 29, wherein the routing mechanism is further configured to determine the routing path between the first and second integrated circuit devices by

identifying one or more obstacles that block the routing path,

changing specified straying limit criteria that defines a routing region in which the routing path between the first and second integrated circuit devices may be placed to generate changed specified straying limit criteria that defines a modified routing region, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the changed specified straying limit criteria, the routing path between the first and second integrated circuit devices.

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33. The system as recited in Claim 29, wherein routing mechanism is further configured to determine the routing path between the first and second integrated circuit devices by

identifying one or more obstacles that block the routing path,

determining a set of one or more layer changes to allow the routing path to avoid the one more obstacles, and

determining, based upon the integrated circuit layout data, the integrated circuit connection data, the set of one or more routing indicators and the set of one or more layer changes, the routing path between the first and second integrated circuit devices.

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